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Diffusion and cell size

Side of cube / cm ± 0.05 cm	Surface area / cm^2 ± 0.05 cm^2	Volume / cm^3 ± 0.05 cm^3	$\frac{\text{Surface area}}{\text{Volume}}$	Distance penetrated / cm ± 0.05 cm	Distance not penetrated / cm ± 0.05 cm	Volume not penetrated / cm^3 ± 0.05 cm^3	% of the total volume not penetrated
1	6	1	6:1	1	—	—	—
2	24	8	3:1	0.5	1	1	12.5
3	54	27	2:1	0.5	2	8	29.6

Discussion questions and answers

- **List the agar cubes in order of size, from largest to smallest. List them in order of surface area – to – volume ratio, from largest to smallest ratio. How does the se lists compare?**
  From largest to smallest in order of size: 3 cm, 2 cm, 1 cm. From largest to smallest in order of surface area – to – volume ratio: 1 cm, 2 cm, 3 cm. It can be concluded that a cube with shorter sides have a larger surface – to – area volume ratio. As a cell grows, the surface area – to – volume ratio will decrease.
- **What evidence is there that sodium hydroxide diffuses into an agar block? Is there any evidence that something was diffusing out of the agar block? Explain.**
  When the sodium hydroxide solution was poured over the agar blocks , the blocks would change in colour; from semi -transparent to a bright pink colour, implicating that the sodium hydroxide solution diffuses into the agar block, in order to react with the phenolphthalein. In t he largest and the second largest blocks (in order of size), it was noted that the sodium hydroxide solution itself had changed in colour, going from colourless to a light pink colour. This change was slightly stronger in the beaker containing the largest agar block. Thus, this gives an indication that phenolphthalein was diffusing out from the agar block and into the sodium hydroxide solution.
- **What happens to the surface area – to – volume ratio of a cell as the cell grows?**
  When a cell increases in size th e surface area – to – volume ratio will decrease in order to bring in essential materials more easily as well as carrying out waste more effectively.
- **When one cube -shaped cell divides into two equal parts, how does the volume of each small cell compare wit h the one large cell? Does the surface area change in the same proportion? Explain.**
  When the cell divides, the volume will remain the same due to the new cell being an exact copy of the cell which it was divided from. Because the cell will keep growing until it is large enough to divide, the splitting will result in two identical cells being the same size. When cell division occurs, the surface area will increase in size for both cells, growing at a rapid rate until it reaches its maximum size.

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- **Propose a hypothesis to answer the following questions. Why does the growth rate of a cell slow down as it gets larger? How does division affect the cell's ability to absorb material for growth?**
  When a cell increases in size, the growth rate will slow down due to the amount of time it takes to get the same proportion of growth . As the cell divides it results in an increase of the surface area, giving the cells a better ability to bring in materials which are needed for growth through diffusion.
- **What does the surface area of the cube represent?**
  The surface area of the cube represents the rate at which different materials enter or leave the cell . This includes essential nutrients entering the cell and waste products exiting the cell. A cell with a larger surface area per unit volume is able to move more materials in and out of the cell. From the table above it can be concluded that the agar block with 1 cm sides, have the largest surface area per unit volume, thus is able to transport a larger amount of materials in and out of the cell.
- **What does the volume of the cube represent?**
  The volume of the cube implies the rate at which different materials are used or produced, such as the production of heat and waste and the rate of consuming resources.